

RP 901 Quality During Wind Project Construction

The following recommended practice (RP) is subject to the disclaimer at the front of this manual. It is important that users read the disclaimer before considering adoption of any portion of this recommended practice.

This recommended practice was prepared by the AWEA Quality Committee. The committee would like to thank:

Primary Authors:

Concepcion Mendoza, Wanzek Construction, Inc.
Karen Tucker, Wanzek Construction, Inc.

Contributing Authors:

Thomas Brazina, EDP Renewables North America LLC
Ryan Griffin, Mortenson Construction
Gregory Lilly, E.ON Climate & Renewables North America
Scott Mathieu, EDP Renewables North America LLC
Gillian Saunders, Siemens
Fritz Oettinger, Vestas

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Purpose and Scope

The scope of “Quality During Wind Project Construction” addresses quality assurance and control during the construction phase of a wind site.

Introduction

The Quality Committee is focused on reducing the levelized cost of energy (LCOE) for wind and creating visibility for and attracting attention to world-class quality standards and processes that reduce wind project costs.

In particular, the construction phase of a wind farm is a key area for cost reduction initiatives. Reviewing the project financials, turbine supply represents approximately 65-75% of total costs, while construction represents an additional 25-35%.

With firm turbine prices, the construction phase of a wind farm poses the most financial risks due to unforeseen variable costs. These costs can significantly impact the internal rate of return (IRR) if not addressed.

Introduction

(continued)

“Quality During Wind Project Construction” includes four separate sample documents that together provide a template for quality assurance and control during the construction phase of a wind site. Certain details in the documents are specific to individual wind project sites but can be easily adapted to site-specific conditions.

- The “Quality Assurance/Quality Plan” provides a framework for attaining required quality levels during wind site construction. It provides management tools for executing quality assurance and quality control and includes documentation of quality protocols and responsibilities for a typical wind site construction project.
- The “Form of Job Books” provides a table of contents view of the typical inspections and tests that are performed and documented to assure quality of construction. Inspections may be deleted, added, or modified based on project specifics.
- The “Inspections and Test Plan” provides an example of a full inspection and test plan for “Civil Construction Block” in the “Form of Job Books”. A similarly detailed inspection and test plan exists for each section of the “Form of Job Books”.
- The “Quality Control Procedure” provides an example of the documented procedure accompanying the “Construction Period Road Inspection” subsection of the “Civil Construction Block”. A similarly detailed procedure exists for each inspection in the full inspection and test plan.

Quality Assurance/Quality Plan

The “Quality Assurance/Quality Plan” provides a framework for attaining required quality levels during wind site construction. It provides management tools for executing quality assurance and quality control and includes documentation of quality protocols and responsibilities for a typical wind site construction project.

1. Revision History

Table A: Revision History

Revision	Date	Description	Approved
0			
1			
2			
3			
4			

2. Introduction/Purpose

The intended purpose of this quality control plan (QCP) is to establish a formal quality assurance (QA) program for the subject project to ensure compliance of the construction effort with the project specifications, applicable codes and standards, and drawing requirements.

The goal of this QCP is to provide a framework for attaining the required level of quality in construction by delineating individual quality assurance/quality control (QA/QC) responsibilities, providing appropriate management tools for their diligent use, establishing procedures for the execution of QA/QC responsibilities, establishing documentation protocols, and ultimately instilling in each individual worker a commitment to produce quality work at all times.

3. Scope

This QCP is applicable for the indicated project and the scope of work contractually assigned to Company Construction Inc., its subcontractors, and its suppliers.

4. Management Responsibility

4.1. Quality Policy

It is the responsibility of Company Construction, Inc. to provide and maintain an effective QCP throughout the duration of the contract. To accomplish our goals of completing the timely construction of the work or project in compliance with the contract documents and applicable codes and standards while providing a safe work environment for our employees and subcontractors, Company Construction, Inc. shall ensure the performance of sufficient pre-planning, inspection, and testing of all work performed incident to this construction effort. The pre-planning, tests, and inspections include all subcontracted and self-performed work. All test and inspections will be performed to validate the quality of materials, workmanship, and functional performance requirements mandated by the contract documents. Test results and inspections will be documented on the appropriate forms and accompanied by a photo and/or video documentation as determined by Company Construction, Inc.

4.2. Organization

4.2.1. President and Vice Presidents

The president and vice presidents are responsible for establishing the direction for quality control throughout Company Construction, Inc.

4.2.2. Director of Project Management

The director of project management (DPM) is responsible for ensuring that the organization adopts and adheres to the quality policy. The director of project management is also responsible for gathering feedback from clients and ensuring that Company Construction, Inc. is an organization committed to customer satisfaction and continuous improvement.

4.2.3. Quality Control Management Team

The quality control management team (QCMT) is responsible to develop policies and procedures that improve quality. The quality control management team is also responsible to measure the quality of the services and products that are provided to our clients and address continual improvement of the quality control program. The quality control management team shall be responsible for the content of the quality control plan. The quality control management team shall review and approve inspection and test plans. The quality control management team shall review and approve non-conformance/corrective action reports. The quality control management team shall assist the project team with all quality related questions.

4.2.4. Project Managers

Project managers (PM) work with the director of project management and the quality control management team to address quality issues and assist with gathering information. Project managers are responsible for implementation of quality in the field and customer satisfaction. The project manager shall review and approve non-conformance/corrective action reports.

4.2.5. Lead Field Engineer

The lead field engineers (LFE) are responsible for overseeing quality in the field and customer satisfaction. The LFE shall develop and implement project specific plans and procedures related to quality. The LFE shall be responsible for reviewing all inspections and test reports. The LFE shall report to the QCM and the PMs all quality related metrics, reports, and issues. The LFE shall assist the PMs with arranging and monitoring third party testing.

4.2.6. Field Engineers

The field engineers (FE) shall be the quality control representatives. The FEs shall follow the guidelines and requirements of the QCP. The FEs shall initiate, follow through, and report on quality related items to ensure that the requirements of the client and Company Construction, Inc. are met. The FEs shall ensure that all required inspection and testing is completed properly. The QCMT, LFE, and the PMs will jointly determine the necessary number of FEs and/or quality organization based on project size, complexity, and scope. FEs shall create and update inspection and test logs. FEs shall follow the guidelines herein, perform inspections and tests, complete the proper documentation and applicable check lists, and report non-conforming conditions to the LFE, project superintendent, and, if appropriate, the PM. FEs shall coordinate, review, and approve third party testing. FEs may be required to perform inspections and tests.

4.2.7. General Superintendent

The general superintendent shall be aware of and follow the guidelines and requirements of the QCP. The general superintendent shall coordinate corrective action when required.

4.2.8. Area Superintendent

The area superintendents shall be aware of and follow the guidelines and requirements of the QCP. Area superintendents shall coordinate with the FEs in auditing the crew foreman's work to ensure the QCP is being followed.

4.2.9. Crew Foreman

Crew foremen shall be aware of and follow the guidelines and requirements of the QCP and the applicable procedures. Crew foremen shall work with the FEs to assure all client and Company Construction, Inc. quality requirements are met and procedures are followed. Crew foremen may be required to perform inspections and tests and complete the inspection documentation forms. Crew foremen shall coordinate with the FEs in auditing the leadmen's work to ensure the QCP is being followed.

4.2.10. Leadmen

Leadmen shall be aware of and follow the guidelines and requirements of the QCP and the applicable procedures. Leadmen shall work with the FEs to assure all client and Company Construction, Inc. quality requirements are met and procedures are followed. Leadmen may be required to perform inspections and tests and complete the inspection documentation forms.

4.2.10. Leadmen (continued)

Leadmen are supervision's first line of quality representation in the field. Leadmen are required to inspect all installation work prior to FEs performing their quality inspections.

4.3. Resources

Company Construction, Inc. shall employ sufficient personnel to implement this QCP. Personnel shall be knowledgeable and properly trained in the work discipline to which they have been assigned. Company Construction, Inc. shall provide qualified agencies, laboratories, consultants, or contractors as necessary to implement the QCP.

5. Drawings and Other Document Control

5.1. Purpose

The purpose of "Drawings and Other Document Control" is to ensure that: pertinent documents are available at points of use, obsolete documents are promptly removed from use, and obsolete documents are retained, suitably marked, and filed.

5.2. Scope

The scope of this section covers: documents from customer/owner, engineer, and Company Construction, Inc. subcontractors and suppliers, as-built documents, third party codes, and standards and submittals.

5.3. Method (Procedure)

The LFE is responsible for this procedure but can delegate portions or all responsibility to competent personnel. Company Construction, Inc. subcontractors and suppliers are responsible for applicable section(s) of this procedure and must provide suitable document control.

5.3.1. Transmittals

The documents received are checked against the letter of transmittal to assure that there are no missing or illegible documents. As is appropriate, the customer/owner, supplier, subcontractor, or consultant is notified in writing of any deficiencies or discrepancies.

5.3.1. Transmittals

(continued)

The documents are logged into the project file log by their respective numbers. If required, one copy will be distributed to customer/owner, supplier, subcontractor, or consultant as is appropriate. Documents are accompanied by a written transmittal or submittal letter. Customer/owner, supplier, subcontractor, or consultant that receives copies is required to acknowledge in writing within 3 working days receipt of the associated documents.

5.3.2. Revisions and Current Documents

If the document(s) received is a revision, obsolete copies are identified as “Void” or “Superseded”. All void or superseded documents shall be filed in their respective void or superseded file.

A log is kept of current documents. The log shall indicate acknowledgement from customer/owner, supplier, subcontractor, or consultant that information was received. Past due acknowledgements shall be followed up on. This log will be administered by the LFE on site and any new revisions shall be facilitated through the LFE.

5.3.3. As-Built Documents/Red-Lining

Company Construction, Inc.’s master set shall also be used as the as-built documents. For self performed work by Company Construction, Inc., subcontractors, and suppliers, each shall be responsible for red-lining as appropriate. The official as-built documents will remain with Company Construction, Inc. until turned over to customer/owner at the end of construction. Red-lining shall be done as changes occur. If revisions to documents are received without the previous changes incorporated, the later revision must be red-lined with the previous changes. The LFE shall facilitate and monitor this process throughout the project duration. The LFE shall perform or delegate weekly inspections of the as-built documents to ensure correctness and adherence to prior agreements.

Final as-built documents incorporating all Company Construction, Inc., subcontractor, and supplier data shall be submitted to the owner/customer in accordance with contract requirements. An electronic copy shall be retained by Company Construction, Inc. for future reference.

5.3.4. Submittals

Company Construction, Inc. shall implement a process to review contract documents, specifications, applicable codes, and Company Construction, Inc. specifications to determine submittal requirements. Company Construction, Inc. shall create a submittal log listing all submittals required by the various entities, contract, or necessity to complete the work. The submittal log shall identify the specific party that is responsible for generating the submittal and will also identify if the submittal requires approval and the associated due dates. Company Construction, Inc. shall be responsible for performing a review of all submittals prior to distribution.

Company Construction, Inc. shall review the submittal log weekly. The report will be used to identify any past due items as well as near term items.

5.3.5. Review of Shop Drawings/Submittals

Shop drawings/submittals shall conform to contract specifications. Submittal shall clearly indicate how the subcontractor or supplier intends to comply with specifications. Submittal shall provide evidence of conformance to specified materials, manufacturer, model numbers, and performance standards. Submittal shall provide a specific procedure for presentation, consideration, review, approval, use, and documentation of substitutions. Submittal shall confirm that the work complies with stipulated standards.

Company Construction, Inc. shop drawings/submittal procedure shall provide for coordination between other subcontractors and suppliers. Particular attention shall be paid to conflicts with work provided by others, interface points, and mechanical and electrical requirements and interface.

Company Construction, Inc. shop drawings/submittal procedure shall confirm that finishes conform to specifications. Upon receipt of a returned shop drawing/submittal, a record is created in the submittal log.

5.3.5. Review of Shop Drawings/Submittals (continued)

Company Construction, Inc. shall review all comments made by the engineer/ owner/customer and confirm all questions are answered. Company Construction, Inc. shall determine if any comments result in a change to the contract. Using a transmittal/ submittal, forward the documents to the appropriate party. Clearly note any further action that is required, provide a “respond by” date, and keep a file copy. Submittals that are rejected must be revised and re-submitted. Forward record copies to the appropriate party.

6. Process Control

6.1. Requests for Information (RFI) Process

6.1.1. Purpose

The intent of the requests for information process is to provide a formal and documented communication process for the purpose of:

- Securing clarification when requirements are not clear or are conflicting
- Obtaining required information for construction activities that are not available in the contract documents
- Communicating non-conformance reports for disposition and/or approval to “use as is” or “repair”

6.1.2. Scope

The scope of the requests for information process covers all issues relative to fulfillment of contract requirements. RFI processes shall be employed between Company Construction, Inc. and its consultants, subcontractors, and suppliers, as well as the customer/owner.

6.1.3. Method (Procedure)

The lead field engineer or designee is responsible for the execution of this procedure. Company Construction, Inc. consultants, subcontractors, and suppliers shall have an equivalent procedure of their own.

6.2. Issue Management

6.2.1. Purpose

The purpose of issue management is to organize project information by issue. This allows for quick reference of any particular subject and supports bringing all issues to closure in a timely manner.

6.2.2. Scope

The scope of issue management is any issues that arise at any stage of a project from inception to close-out and warranty. Issues can be related to cost, schedule, scope of work, specifications, estimates, quotations, documents, contractor, subcontractor, owner/customer, RFIs, and responsibilities. Company Construction, Inc.'s project issue log shall be used to record, inventory, track, and close issues.

6.2.3. Method (Procedure)

At such time as an issue arises, or it is determined by the project team that an issue may arise, the following information shall be tracked: date of issue, description of issue, issue progress, issue resolution date, and description of issue resolution. All documents, regardless of origin, that are applicable to an issue shall be linked to that issue in the issue folder.

The PM shall affix responsibility, initiate any cost or charge calculations, issue notifications to the parties involved with a specific issue, direct work, obtain authorizations, and effect settlement. All tasks shall be identified and documented in the respective issue number assigned.

6.3. Plan of the Day Meeting/Report

6.3.1. Purpose

The purpose of the plan of the day meeting/report is to establish an effective communication process for indicated project construction activities.

6.3.2. Scope

The following is a summary list of the items that will be discussed at the plan of the day meeting and included in the plan of the day report (POD):

- Project milestones
- Construction activities
- Site safety
- Project issues
- General construction status

6.3.3. Method (Procedure)

The LFE or designee is responsible for the execution of this procedure. The LFE or designee shall coordinate with project team members at a specific time daily to conduct the plan of the day meeting. Upon completion of the plan of the day meeting, information discussed shall be recorded on the POD report and issued to all applicable parties.

7. Civil

7.1. Purpose

The purpose of this section is to establish and delineate the task planning and quality assurance methods and procedures to be used for the testing, examination, and inspection of site roadway, crane pad, and foundation excavation and backfill.

7.2. Scope

The following is a summary list of the operations and items for which quality control functions will apply:

- Road subgrade width and compaction
- Road final grade, width, profile, and compaction
- Foundation construction
- Crane pad construction
- Site reclamation

7.3. Method (Procedure)

The LFE or designee is responsible for the execution of this section. Prior to execution of work, a planning meeting shall be held. At the planning meeting, the project superintendent, civil superintendent and project manager shall review project specifications and installation procedures required per engineering/customer/owner requirements.

A survey control system for those items deemed necessary by Company Construction, Inc. shall be established and baselines/benchmarks shall be located on-site. As deemed appropriate by Company Construction, Inc., survey work performed by or for subcontractors may be independently verified by an independent professional surveyor provided by Company Construction, Inc..

The customer/owner shall be responsible to provide the precise location of each WTG. Company Construction, Inc. shall obtain customer/owner approval of the physical location of each WTG prior to beginning work at each location.

7.3.1. Subcontractors

Company Construction, Inc. subcontractors shall have a procedure of their own that equals or exceeds this procedure. Prior to execution of work, a planning meeting shall be held. At the planning meeting, the subcontractors shall demonstrate the quality plan that will be followed. Subcontractors shall also provide examples of supporting documentation to verify compliance with the quality plan for the work.

7.3.2. Site Access Roads

Prior to performing any road construction or placing any new road material, the road position shall be verified by a survey which shall indicate through the use of marking stakes the precise location of the roadway easement and the position of the road within the easement. The surveyor shall provide documentation in a format approved by Company Construction, Inc. that the roadway easement stakes and road location are in the proper position.

Prior to performing any road construction or placing new road material, the road subgrade will be inspected by an independent testing agency. The documentation provided by the independent agency shall include, as a minimum, the information detailed in Section 7.3.7.

7.3.2. Site Access Roads (continued)

Upon completion of roadway construction, the roads and any newly installed drainage structures will be inspected for proper placement, width, thickness, grade elevation, crown, and side slope and tested for compaction. Placement, width, thickness, grade elevation, crown, and side slope shall be documented on the “C-1 Road Inspection” form and “C-2 Drainage Structure Inspection” form. The compaction testing will be performed and documented by an independent testing agency. The documentation shall comply with the provisions outlined in Section 7.3.7.

The civil inspection forms and compaction test reports shall become part of the turnover package to the owner/customer.

7.3.3. Foundation Excavation

Prior to foundation excavation, the PE or designee shall verify that the turbine location coordinates are accurate. Foundation excavation shall be inspected and documented by an independent testing agency. The inspection shall be reviewed and approved by the testing agency’s geotechnical engineer. The documentation shall comply with the provisions outlined in Section 7.3.7.

Turbine foundation excavations shall be visually inspected prior to concrete placement to ensure the bottom excavation is consistent with design requirements. A photographic record of the excavated area shall be made immediately prior to concrete placement. The “F-1 Foundation Excavation Inspection” form shall be completed prior to concrete placement.

The “C-5 Drain Tile Repair Inspection” form shall be completed if any drain tile is damaged during construction operations.

The “F-1 Foundation Excavation Inspection” form and third party subgrade acceptance report shall become part of the turnover package to the owner/customer.

7.3.4. Foundation Grounding and Pre-Backfill

A visual and mechanical inspection of grounding system shall be conducted to ensure grounding cable, ground rods, and exothermic or mechanical ground connection(s) are in compliance with project drawings and specification. The “F-9 Foundation Grounding and Pre-Backfill Inspection” form shall be utilized on each inspection. A photographic record of the ground grid shall be made prior to commencing foundation backfill operations. The foundation ground grid shall be tested according to contract specification upon backfill completion. The “F-9 Foundation Ground Grid Inspection” form and ground grid test results will become part of the turnover package to the owner/customer.

Prior to placing earth backfill at turbine foundations, an inspection shall be conducted to ensure all cracks have been sealed on foundation and all debris has been removed from foundation area. Once concrete strength has reached design specifications, backfill will proceed.

7.3.5. Foundation Backfill

A meeting will be held with the third party testing agency to discuss the backfill testing parameters. Foundation backfill shall be completed and tested according to engineer specifications and/or owner/customer specifications. The compaction testing will be performed and documented by an independent testing agency. The documentation shall comply with the provisions outlined in Section 7.3.7. The compaction test report shall become part of the turnover package to the owner/customer.

7.3.6. Crane Pad

Upon completion of crane pad construction, the pad will be inspected for length, width, distance from center-of-foundation to center-of-pad, levelness, and compaction found. Length, width, center-to-center distance and levelness will be documented on the “C-3 Crane Pad Inspection” form. The compaction test will be performed and documented by an independent testing agency. The documentation shall comply with the provisions outlined in Section 7.3.7. The compaction test report shall become part of the turnover package to the owner/customer.

7.3.7. Material Compaction Report Items

Independent testing agency inspection and test reports for material compaction shall include, but shall not be limited to, the following:

- Date
- Location of test
- Description of material tested
- Test reports shall reference project specifications.
- Description of tests performed including references to appropriate standards
- Material moisture content
- Material wet density
- Material dry density
- Sieve analysis, when deemed necessary by engineer of record
- Material compaction value in place
- Name and signature of test technician
- Name, signature, and registration number of professional engineer responsible for the content of the report
- Stamp or seal of professional engineer responsible for the content of the report as required per specifications
- A statement that the test results pass or are not in compliance with the applicable requirements.

8. Wind Turbine Generator Foundation

8.1. Purpose

The purpose of this section is to establish and delineate the task planning and quality assurance methods and procedures to be used for the testing, examination, and inspection of reinforcing steel installation, formwork, concrete placement, and WTG base grout placement.

8.2. Scope

The following is a summary of the operations and items for which quality control functions will apply:

- Concrete mix design approvals
- Ready mix supplier qualifications
- Reinforcing steel installation
- Formwork
- Embedded items
- Concrete placement
- Concrete testing
- Concrete curing and protection
- Grout placement

8.3. Method (Procedure)

The PM or designee is responsible for the execution of this procedure. Company Construction, Inc. subcontractors shall have an equivalent procedure of their own.

8.3.1. Concrete Mix Design Approval

The PM or designee is responsible for execution of this procedure. Using the submittal procedure, Company Construction, Inc. shall request and obtain from the ready mix concrete supplier the concrete design information, stamped and certified by a registered professional engineer, providing a detailed description of the concrete mix or mixes the supplier intends to use. This information shall also include compressive strength test results of the actual mix or mixes the supplier intends to use.

Upon receipt of the mix design information and compressive strength test results, Company Construction, Inc. shall, using the submittal procedure, forward the information and results to the structural engineer of record responsible for the foundation design. The structural engineer of record shall review the information and results and provide Company Construction, Inc. specific direction, if necessary, as to the suitability for use, or concrete mix design modifications necessary to make suitable for use. Company Construction, Inc. shall transmit the review and direction of the design professional to the ready mix supplier. Upon conclusion of this process, at such time as the structural engineer of record has approved the mix or mixes to be used, the structural engineer of record shall provide their approval in writing to Company Construction, Inc.. Once approved by the structural engineer, Company Construction, Inc. shall submit approved design to owner/customer.

8.3.1. Concrete Mix Design Approval (continued)

Upon successful completion of the steps outlined in this section, the PM or designee shall hold a pre-placement planning meeting that shall include the concrete supplier batch plant manager, batch equipment operator, delivery truck dispatcher, and Company Construction, Inc. FE, superintendent, and/or foremen, as deemed appropriate by the PM. The purpose of this meeting is to plan in detail the work to be completed, the expectations to be met, paying particular attention to the quality and consistency of the concrete, the delivery time requirements, truck cycle times, number of trucks to be used, truck rejection parameters, truck wash out requirements, length of work day, location of work, communication protocol between Company Construction, Inc. and concrete supplier, safety requirements, and training. Subsequent pre-pour meetings shall be held as deemed appropriate by the PM or designee.

No structural concrete may be poured on the subject project until this process is complete.

8.3.2. Mill Certification

A mill certification form shall be provided by the manufacturer at the time of delivery of the anchor bolts, embed rings, and reinforcing steel used on the project. Embedment of these items shall not take place until the mill certifications have been received by Company Construction, Inc.. All mill certifications shall be submitted to the structural engineer for approval. The mill certifications shall become part of the turnover package to the owner/customer.

8.3.3. Pre-Concrete Placement

Pre-concrete placement forms are required to be completed prior to each mud mat, base, and pedestal foundation installation. The responsible foremen for each discipline of work, i.e. formwork, reinforcing steel installation, anchor bolts, electrical, and other embeds, will personally indicate satisfactory completion of their work by initialing the appropriate form prior to all concrete placements. These forms will become part of the turnover package to the owner/customer.

The following forms shall be completed prior to concrete placement:

- F-1 Foundation Excavation Inspection
- F-3 Anchor Bolt Cage Inspection
- F-4 Foundation Conduit Inspection
- F-5 Base Pre-Pour Inspection
- F-7 Pedestal Pre-Pour Inspection

8.3.3.1. Structural Engineer Approval

The structural engineer of record shall review the formwork, reinforcing steel installation, anchor bolt cage installation, electrical, and other embeds prior to concrete placement. This review shall be conducted at the start of the WTG foundation operations. At a minimum, two (2) foundation bases and two (2) foundation pedestals shall be inspected and approved by the structural engineer of record prior to concrete placement.

8.3.4. Concrete Placement

A concrete placement form will be completed for every mud mat, base, pedestal, or other concrete placement executed on this project by Company Construction, Inc.. These forms will become part of the turnover package to the owner/customer.

The following forms shall be completed during concrete placement:

- F-2 Mud Mat Inspection
- F-6 Base Concrete Placement Inspection
- F-8 Pedestal Concrete Placement Inspection

8.3.5. Concrete Testing

An independent testing company will be utilized to sample and test concrete from each placement. A record of concrete test specimen results will be provided by the independent testing company using their standard report form. Concrete test cylinders shall be made following the recommendations of the ACI, with one set made within the first 50 cubic yards placed and one additional set made within each 150 cubic yards placed thereafter or according to foundation specifications. Cylinders shall be made, handled, and cured in accordance with ASTM C31 and shall be strength tested in accordance with ASTM C39 along with foundation specifications. Testing reports shall become part of the turnover package to the owner/customer.

9. Wind Turbine Generator Component Receiving

9.1. Purpose

The purpose of this section is to ensure that receiving, inspection, and testing requirements, as required by applicable code, standard, or regulatory body and as described in the project contract documents, are fulfilled by Company Construction, Inc., a subcontractor, or a supplier, as may be applicable.

9.2. Scope

All work including direct and indirect purchased material and equipment within the scope of work described by the project contract is covered by this procedure. Inspection and testing may be performed by Company Construction, Inc., a subcontractor, or a supplier, as may be applicable.

9.3. Method

The LFE or designee is responsible for the execution of this procedure. Company Construction, Inc. subcontractors and suppliers are responsible for using this procedure or an equivalent one of their own for work covered by the contract for their services.

All incoming material and equipment shall be subject to a receiving inspection upon arrival utilizing the following inspection forms:

- R-1 Controller Receiving Inspection
- R-2 Tower Section Receiving Inspection
- R-3 Nacelle Receiving Inspection
- R-4 Hub Receiving Inspection
- R-5 Blade Receiving Inspection

The receiving inspections shall be performed to assess the condition of the item(s) being received including verification of quantities, model numbers, serial or mark numbers, and compliance with the contract or other document which authorized its purchase, visual inspection, or non-destructive testing for damage or deterioration and compliance with applicable design tolerances.

A photographic and/or video record of all incoming components, equipment, and materials which are actually damaged or deteriorated or suspected of damage or deterioration shall be made.

All deliveries shall be logged and recorded into the plan of the day (POD) report or a suitable delivery log.

All testing shall be performed in accordance with applicable codes, standards, or regulatory bodies. Test reports shall be generated by the party performing the test and provided to Company Construction, Inc. within five (5) calendar days of completion.

9.3. Method (continued)

Projects shall maintain product identification and material traceability according to the requirements of the contract. Tracking logs and receiving forms shall be set up in aiding this process. All material manufacturer and receiving records shall be filed on site and recorded in the tracking logs. Where appropriate, the owner/customer shall participate in the inventory and inspection of received goods. The inventory shall validate count, conformance with specifications, damage, if any, and place of storage or use upon offloading. Any deficiencies shall be noted on the appropriate receiving inspection form and communicated to the transportation company and vendor. In addition, a non-conformance report shall be issued to the vendor and applicable parties.

10. Wind Turbine Generator Installation

10.1. Purpose

The purpose of this section is to establish and delineate the quality assurance methods and procedures to be used for the erection, assembly, testing, examination, and inspection of wind turbine generator components.

10.2. Scope

The following is a summary list of the operations and items for which quality control functions will apply:

- Tower section erection
- Grout installation and testing
- Base tensioning and testing
- Rotor and nacelle construction
- Tower wiring
- Mechanical completion

10.3. Method

The LFE or designee is responsible for the execution of this procedure. Company Construction, Inc. subcontractors are responsible for using this procedure or an equivalent one of their own. As applicable, Company Construction, Inc. shall incorporate the manufacturer installation procedures into the QCP by utilizing the manufacturing check lists or by modifying Company Construction, Inc. internal inspection forms.

10.3.1. Base Erection

The “E-1 Base Erection Inspection” form shall be utilized or modified as appropriate for the specific manufacturer prior to the erection of base section. The “E-1 Base Erection Inspection” form shall become part of the turnover package to the owner/customer.

10.3.2. Grout Installation and Testing

After the base tower section is erected, the base tower will be grouted with an engineer approved high strength grout which meets the design specifications of the structural engineer of record. Grout shall be placed according to grout manufacturer installation procedure and recommendations. The “E-2 Grout Placement Inspection” form shall be completed for every tower base.

Company Construction, Inc. or an independent testing company shall take grout cube samples for testing. The independent testing company shall perform strength testing of grout cubes.

Grout test cubes shall be made, handled, and cured following the requirements of ASTM C1107. Only brass molds with clamped covers shall be used. Release agents shall not be used in the molds. Reference the foundation IFCs for total amount of grout cubes to be made for each WTG grout base. Grout shall be tested for compressive strength following the requirements of ASTM C109.

The grout placement inspection form and grout compressive strength test results shall become part of the turnover package to the owner/customer.

10.3.3. Base Tensioning

Once the base tower grout has reached the specified minimum design strength, the foundation anchor bolts may be tensioned. After the foundation anchor bolts are initially tensioned, the tension will be verified by a Company Construction, Inc. PE or designee. The tensioning process shall be conducted by randomly selecting 10% of the interior anchor bolts and 10% of the exterior anchor bolts. Testing shall be performed immediately or as soon as practical upon completion initial tensioning. The “E-3 Base Tensioning and 10% Inspection” form shall be completed for every tower base.

10.3.4. Tower Lower Mid, Upper Mid, and Top Erection

The WTG installation may include one or more mid sections and the top section, depending on turbine manufacturer. Each inspection form shall be utilized or modified, as appropriate for the specific manufacturer, prior to the erection of each section. Tower Inspection Forms shall become part of the turnover package to the owner/customer.

10.3.5. Nacelle Erection

The “E-7 Nacelle Pre-Lift Inspection” form shall be utilized or modified as appropriate for the specific manufacturer and completed prior to erection of the nacelle. The “E-8 Nacelle Erection Inspection” form shall be utilized or modified, as appropriate for the specific manufacturer, following erection. The nacelle inspection forms shall become part of the turnover package to the owner/customer.

10.3.6. Rotor Erection

The “E-9 Rotor Assembly Inspection” form shall be utilized or modified as appropriate for the specific manufacturer and completed prior to erection of the rotor. The “E-10 Blade to Hub 10% Inspection” form shall be utilized once the rotor is completely assembled. The “E-11 Rotor Erection Inspection” form shall be utilized or modified as appropriate for the specific manufacturer and completed once the rotor is erected. The rotor inspection forms shall become part of the turnover package to the owner/customer.

10.3.7. Wind Turbine Generator (WTG) 10% Check

The “E-13 WTG 10% Inspection” form shall be utilized or modified as appropriate for the specific manufacturer and completed immediately, or as soon as practical, upon completion of WTG erection. The “E-13 WTG 10% Inspection” form shall become part of the turnover package to the owner/customer.

10.3.8. Wind Turbine Generator Wiring

Prior to WTG wiring, a pre-installation meeting shall be conducted by LFE or designee. A review of the WTG installation manual shall be completed by Company Construction, Inc. management, sub-contractors, and owner/customer. All WTG wiring shall be in accordance with the manufacturer installation manual unless changes have been agreed upon in writing between manufacturer, owner/customer, and Company Construction, Inc..

A calibration certificate is required of all tooling and equipment used for production and 10% checks. All tool calibration certificates shall be turned over to Company Construction, Inc. at the pre-installation meeting. A calibration certificate must be presented and approved by Company Construction, Inc. site management prior to use. Daily inspection of tooling and equipment is mandatory. Tooling calibration certificates shall become part of the turnover package to the owner/customer.

If WTG contains MV cable splices or terminations, Section 11.3.4 “MV Cable Splicing and Terminating” shall be strictly adhered to.

WTG wiring shall follow NESCTM and NECTM standards to guarantee a quality installation.

11. Collection System

11.1. Purpose

The purpose of this section is to establish and delineate the task planning and quality assurance methods and procedures for installation, examination, and testing of electrical cable, equipment, and material during construction installation and pre-commissioning.

11.2. Scope

The following is a summary list of the operations and items for which quality control functions will apply:

- Quality assurance of installation
- Field quality control and testing requirements
- Inspection and testing services
- Manufacturers field services

11.3. Method (Procedure)

The LFE or designee is responsible for the execution of this section. Prior to execution of work, a planning meeting shall be held. At the planning meeting Company Construction, Inc. site management shall review quality control inspections, project specifications, and installation procedures required per engineering and owner/customer requirements.

The design and construction will follow all applicable NESCTM and NECTM standards to guarantee a quality installation. Company Construction, Inc. will have experienced on site QA/QC as well as electrical management for the indicated project.

11.3.1. Subcontractors

Company Construction, Inc. subcontractors shall have a procedure of their own that equals or exceeds this procedure. Prior to execution of work, a planning meeting shall be held. At the planning meeting, the subcontractors shall demonstrate the quality plan that will be followed. Subcontractors shall also provide examples of supporting documentation to verify compliance with the quality plan for the work.

Contractor field, inspection, and test reports shall be furnished to Company Construction, Inc. within the timeframe stated in contract documents. All applicable inspections and test reports shall become part of the turnover package to the owner/customer.

11.3.2. Quality Assurance of Installation

All equipment, materials, products, design, and construction shall be in conformance with contract documents, design drawings, and specifications. All equipment, materials, and products shall be stored per manufacturer's instructions and contract specifications.

Monitor quality control of suppliers and manufacturers of material and equipment and providers of engineering and construction services. Monitor site conditions and workmanship to produce work of specified quality, and comply with all applicable and specified standards, tolerances, codes, or requirements.

Comply fully with manufacturers' installation instructions, including each step in sequence. If the manufacturers' instructions conflict with contract documents, request clarification before proceeding.

11.3.2. Quality Assurance of Installation (continued)

Perform work using persons qualified to produce workmanship of specified quality.

A thorough inspection shall be performed as required by laws, codes, regulations, or specifications and shall confirm and document that all installations have been reviewed, are complete, and are in conformance with applicable specifications and workmanship requirements.

The design and construction will follow all applicable NESCTM and NECTM standards to guarantee a quality installation.

11.3.3. Medium Voltage, Low Voltage, and Fiber Optic Cable

All incoming MV, LV, and/or DLO and fiber optic cable reels shall be visually inspected for damage upon delivery. Cable manufacturer, serial number, and length shall be recorded on the applicable tracking log. Manufacturer test reports for each cable reel shall be reviewed to ensure it meets project specifications.

MV, LV, or DLO and fiber optic cable shall be tested in accordance with project specifications, established test protocols, and safety requirements.

Each conductor shall be tested individually before making wiring terminal connections and test results recorded on appropriate test form. If specified test values are not met, further testing to isolate the problem may be needed. Company Construction, Inc. management shall be notified immediately of any failed testing. If desired insulation resistance cannot be obtained, new cable shall be installed and tested.

Manufacturer and field test results shall become part of the turnover package to the owner/customer.

11.3.4. MV Cable Splicing and Terminating

It is Company Construction, Inc.'s policy that no individual can perform or assist with MV cable splicing or terminating without completing training sponsored by the manufacturer of the splice or termination kit. MV cable splicing or terminating shall not be conducted until this training has been completed. If an individual has had site specific training conducted by the manufacturer of the splice or termination kit from a previous Company Construction, Inc. project, and the training has been completed within the last 6 months, site specific training may be waived by Company Construction, Inc. management.

All MV splices and terminations are to be installed by carefully following the manufacturer's instructions. Before installing any splice, lug, or terminal, the conductor shall be verified by inspection and by measurement to ensure that the connector matches the conductor size and type. Compression tools and dies must be as recommended by lug or terminal manufacturer. All installations shall be in strict accordance to manufacturer's installation instructions.

A calibration certificate is required of all tooling and equipment used to perform splicing or terminating. A calibration certificate must be presented and approved by Company Construction, Inc. site management prior to use. Daily inspection of tooling and equipment is mandatory.

Qualification certificates for all cable splicer and tooling calibration certificates shall become part of the turnover package to the owner/customer.

11.3.5. Collection System Installation

Prior to underground cable installation, a pre-installation meeting shall be conducted by LFE or designee. A review of the collection system drawings and specifications shall be completed by Company Construction, Inc. management, subcontractors, and owner/customer. Required installation practices shall be discussed, and all applicable quality control inspections, specifications, and drawings shall be reviewed.

11.3.5. Collection System Installation

(continued)

All subcontractors shall submit a detailed cable management plan to the Company Construction, Inc. electrical superintendent prior to beginning underground cable installation operations. The cable management plan shall be reviewed and approved by the Company Construction, Inc. electrical superintendent.

During direct bury cable installation, monitor and inspection shall be conducted throughout installation process. Cable manufacturer installation requirements for bend radius and cable tension will be strictly adhered to. The inspection shall be documented on the cable installation inspection form and included in the turnover package to the owner/customer.

In the event that an underground cable splice, intermediate ground, fiber splice, or directional bore is installed, the applicable inspection form shall be completed. GPS coordinates for underground cable splice, intermediate ground, fiber splice, or directional bore shall be recorded using the project standard GPS datum. GPS coordinates shall be recorded into the project GPS index log and updated on the project as-built drawings. The applicable inspection form shall become part of the turnover package to the owner/customer.

For each junction box, cross bond box, or fiber splice box, the applicable inspection form shall be completed. All GPS coordinates shall be recorded into the project GPS index log and updated on the project as-built drawings. The applicable inspection form shall become part of the turnover package to the owner/customer.

The “C-5 Drain Tile Repair Inspection” form, as appropriate, shall be completed if any drain tile is damaged during construction operations.

11.3.6. Equipment

All incoming transformers or switchgears shall be subject to a receiving inspection upon arrival, utilizing the appropriate receiving inspection form. Equipment identification number or serial number and designation shall be recorded into the appropriate receiving log. Manufacturer's test reports and receiving inspection forms shall become part of the turnover package to the owner/customer.

Transformer or switchgear installation and cable terminations shall be inspected utilizing the transformer or switchgear inspection form. Inspection of cable terminations, torque value, equipment grounding, and nameplate data shall be conducted. Inspection reports shall become part of the turnover package to the owner/customer.

Prior to transformer energization, the electrical superintendent or competent designee shall utilize a Hastings™ Meter, or "Last Chance Meter", to check for proper phasing of low voltage conductors. The transformer energization check list form shall be utilized upon energization to record voltage and phase rotation. The transformer energization check list shall become part of the turnover package to the owner/customer.

11.3.7. Independent Inspection and Testing Services

Perform and document inspection and field testing. Reports will be submitted to Company Construction, Inc. within the time specified, but under no circumstances more than five (5) calendar days of completion, indicating observations and results of tests and indication compliance with contract documents.

Reports indicating non-compliance with contract documents shall be submitted to Company Construction, Inc. within two (2) calendar days of completion. Company Construction, Inc. will compile all reports and submit them to the owner/customer with the final turnover package.

Provide suitable safety precautions and protection per OSHA and NESCTM during field testing. Only trained and qualified personnel shall operate test equipment. Additionally, ground and discharge equipment to make the equipment safe after high potential testing.

11.3.7. Independent Inspection and Testing Services
(continued)

Perform system functional testing after component acceptance testing is complete to verify that all equipment and systems will operate properly. Company Construction, Inc. shall notify owner/customer in advance to allow witnessing.

11.3.8. Manufacturers' Field Services and Reports

If necessary to comply with manufacturers' warranty terms, or if specified in contract documents, arrange for material or equipment suppliers or manufacturers to provide qualified staff personnel (field representative) to perform the following services:

- Observe and document site conditions, conditions of installation, and quality of workmanship.
- Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- Assist with field assembly as required.
- Supply required test equipment.
- Perform and record the results of manufacturer recommended inspections and tests and tests specified for material and equipment following established test protocols.
- Be responsible for protection of material and equipment and safety of all personnel during testing.
- Perform any other services normally recommended or provided by field representative's company.
- Instruct operating personnel in proper use of material, equipment, and systems.
- Instruct, supervise, and validate any required field repairs prior to acceptance by owner/customer.
- Submit reports of activities, actions taken, and test results to Company Construction, Inc. within five (5) calendar days of completion.

12. Substation and/or Interconnect

12.1. Purpose

The purpose of this section is to establish and delineate the task planning and quality assurance methods and procedures for installation, and to establish and delineate the examination and testing of electrical cable, equipment, and material during construction installation and pre-commissioning.

12.2. Scope

The following is a summary list of the operations and items for which quality control functions will apply:

- Quality assurance of installation
- Inspection and testing services
- Manufacturers field services
- Field quality control and testing requirements

12.3. Method (Procedure)

The LFE or designee is responsible for the execution of this section. Prior to execution of work, a planning meeting shall be held. At the planning meeting, Company Construction, Inc. site management shall review quality control inspections, project specifications, and installation procedures required per engineering and owner/customer requirements.

The design and construction will follow all applicable NESCTM and NECTM standards to guarantee a quality installation. Company Construction, Inc. will have experienced on site QA/QC as well as electrical management for the indicated project.

12.3.1. Subcontractors

Company Construction, Inc. subcontractors shall have a procedure of their own that equals or exceeds this procedure. Prior to execution of work, a planning meeting shall be held. At the planning meeting, the subcontractors shall demonstrate the quality plan that will be followed. Subcontractors shall also provide examples of supporting documentation to verify compliance with the quality plan for the work.

Contractor field reports, inspection, and test reports shall be furnished to Company Construction, Inc. within the timeframe stated in contract documents. All applicable inspections and test reports shall become part of the turnover package to the owner/customer.

12.3.2. Quality Assurance and Control of Installation

All equipment, materials, products, design, and construction shall be in conformance with contract documents, design drawings, and specifications. All equipment, materials, and products shall be stored per manufacturer's instructions and contract specifications.

Monitor site conditions and workmanship to ensure work complies with all applicable and specified standards, tolerances, codes, or requirements and is completed per contract drawings, specifications, and specified quality. Monitor quality control of suppliers and manufacturers of material and equipment and providers of engineering and construction services. Monitor site conditions and workmanship to produce work of specified quality.

Comply fully with manufacturers' installation instructions, including each step in sequence. If the manufacturers' instructions conflict with contract documents, request clarification before proceeding.

Perform work using persons qualified to produce workmanship of specified quality.

A thorough inspection shall be performed as required by laws, codes, regulations, or specifications and shall confirm and document that all installations have been reviewed, are complete, and are in conformance with applicable specifications and workmanship requirements, including verification of installation of covers on boxes, fittings, and apparatus and are weather tight if required

Pre-commission energizing of electrical equipment will be conducted only when specified and only with permission from owner/customer and Company Construction, Inc. All LOTO procedures shall be strictly enforced. All applicable inspections and test reports shall become part of the turnover package to the owner/customer.

The design and construction will follow all applicable NESCTM and NECTM standards to guarantee a quality installation.

12.3.3. Receiving

All incoming material, components, and structures shall be subject to a visual inspection upon arrival. All equipment, materials, products, design, and construction shall be in conformance with contract documents, design drawings, and specifications and the requirements of this section. The equipment receiving inspection form shall be utilized upon receipt of large equipment components. The equipment receiving inspection form shall become part of the project turnover package to owner/customer.

12.3.4. Grounding System

A visual and mechanical inspection of grounding system shall be conducted to ensure grounding cable, ground rods, and exothermic or mechanical ground connection(s) are in compliance with engineer drawings and specification. Verify all substation structures, equipment, buildings, switch stands, fencing, and gates are grounded properly. The ground grid inspection form shall be utilized for this inspection.

Substation ground grid shall be tested according to engineer specifications and recommendations. Substation ground grid inspection and test results shall become part of the project turnover package to owner/customer.

12.3.5. Foundations

Foundation excavations shall be visually inspected prior to concrete placement to ensure excavation and reinforcing steel is consistent with design requirements.

An independent testing agency will be utilized to test subgrade compaction. Testing shall be conducted per engineer specifications and owner/customer requirements. The foundation excavation inspection form and subgrade test reports shall become part of the turnover package to the owner/customer.

12.3.6. Mill Certification

A mill certification form shall be provided by the manufacturer at the time of delivery of the anchor bolts, embed rings, and reinforcing steel used on the project. Embedment of these items shall not take place until the mill certifications have been received by Company Construction, Inc. All mill certifications shall be submitted to the structural engineer for approval. The mill certifications shall become part of the turnover package to owner/customer.

12.3.7. Concrete Testing

An independent testing agency will be utilized to sample and test concrete. A record of concrete test specimen results will be provided by the independent testing company using their standard report form. Concrete test cylinders shall be made following the recommendations of the ACI or according to foundation specifications. Cylinders shall be made, handled, and cured in accordance with ASTM C31 and shall be strength tested in accordance with ASTM C39 along with foundation specifications. Test reports shall become part of the turnover package to the owner/customer.

12.3.8. Structure and Equipment Installation

The structure and equipment inspection forms shall be utilized or modified according to project specifications. Forms shall become part of the turnover package to the owner/customer.

12.3.9. Overhead Bus

Aluminum welding shall be conducted by a certified welder. Copies of welding certifications shall be filed. Insulators and bus shall be thoroughly clean prior to energizing per manufacturer's instructions. A final cleaning shall be provided of equipment and the removal of construction debris at associated work area prior to placing system in service. The overhead bus inspection form shall be utilized to complete this inspection. The inspection form shall become part of the turnover package to owner/customer.

12.3.10. Substation/Interconnect Yard

The substation/interconnect yard inspection form shall be utilized for this inspection. An inspection shall be conducted to ensure warning signs, equipment or steel structure labels, fencing/gates, yard lighting, and gravel installation is completed per project design and specifications. The inspection form shall become part of the turnover package to owner/customer.

12.3.11. Large Equipment, Relay, and Control Panels

- Consult manufacturers' instructions for assembly, installation, and testing of equipment following established testing and safety protocols.
- Visually inspect physical and mechanical condition upon delivery.
- Compare equipment nameplate data with drawings and specifications.
- Check for adequate clearances between energized parts and to ground.
- Perform and document point-to-point wire checks of field circuits prior to functional testing.
- Verify proper polarity, phasing, and CT/PT taps of current and voltage inputs.
- Calibrate and program relays and meters per the engineer of record settings and manufacturer's instructions.
- Functionally check control and indication devices by operating the associated equipment.
- Instruct owner/customer operating personnel in proper equipment use if requested.

12.3.12. Independent Inspection and Testing Services

Perform and document inspection and field testing per contract requirements and specifications. Reports will be submitted to Company Construction, Inc. within the time specified, but under no circumstances more than five (5) calendar days of completion, indicating observations and results of tests and indicating compliance with contract documents.

12.3.12. Independent Inspection and Testing Services (continued)

Provide suitable safety precautions and protection per OSHA and NESCTM during field testing. Only trained and qualified personnel shall operate test equipment. Additionally, ground and discharge equipment to make the equipment safe after high potential testing.

Perform system functional testing after component acceptance testing is complete to verify that all equipment and systems will operate properly. Company Construction, Inc. shall notify owner/customer in advance to allow witnessing.

12.3.13. Manufacturers' Field Services and Reports

If necessary to comply with manufacturers' warranty terms, or if specified in contract documents, arrange for material or equipment suppliers or manufacturers to provide qualified staff personnel (field representative) to perform the following services:

- Observe and document site conditions, conditions of installation, and quality of workmanship.
- Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- Assist with field assembly as required.
- Supply required test equipment.
- Perform and record results of manufacturer recommended inspections and tests and tests specified for material and equipment following established test protocols. Be responsible for protection of material, equipment, and safety of all personnel during testing.
- Perform any other services normally recommended or provided by the field representative's company.
- Instruct operating personnel in proper use of material, equipment, and systems.
- Instruct, supervise, and validate any required field repairs prior to acceptance by owner/customer.
- Submit reports of activities, actions taken, and test results to Company Construction, Inc. within five (5) calendar days of completion.

13. Transmission Line

13.1. Purpose

The purpose of this section is to establish project quality assurance methods and procedures for installation, examination, and testing of electrical cable, equipment, and material during construction installation.

13.2. Scope

The following is a summary list of the operations and items for which quality control functions will apply:

- Quality assurance of installation
- Inspection and testing services
- Manufacturers field services
- Field quality control and testing requirements

13.3. Method (Procedure)

The LFE or designee is responsible for the execution of this section. Prior to execution of work, a planning meeting shall be held. At the planning meeting, Company Construction, Inc. site management shall review quality control inspections, project specifications and installation procedures required per engineering, and owner/customer requirements.

The design and construction will follow all applicable NESCTM and NECTM standards to guarantee a quality installation. Company Construction, Inc. will have experienced on site QA/QC and electrical management for the indicated project.

13.3.1. Subcontractors

Company Construction, Inc. subcontractors shall have a procedure of their own that equals or exceeds this procedure. Prior to execution of work, a planning meeting shall be held. At the planning meeting, the subcontractors shall demonstrate the quality plan that will be followed. Subcontractors shall also provide examples of supporting documentation to verify compliance with the quality plan for the work.

Contractor field, inspection, and test reports shall be furnished to Company Construction, Inc. within the timeframe stated in contract documents. All applicable inspections and test reports shall become part of the turnover package to the owner/customer.

13.3.2. Quality Assurance and Control of Installation

All equipment, materials, products, design, and construction shall be in conformance with contract documents, design drawings, and specifications. All equipment, materials, and products shall be stored per manufacturer's instructions and contract specifications.

Monitor site conditions and workmanship to ensure work complies with all applicable and specified standards, tolerances, codes, or requirements and is completed per contract drawings, specifications, and specified quality.

Monitor quality control of suppliers and manufacturers of material and equipment and providers of engineering and construction services. Monitor site conditions and workmanship to produce work of specified quality.

Comply fully with manufacturers' installation instructions, including each step in sequence. If manufacturers' instructions conflict with contract documents, request clarification before proceeding.

Perform work using persons qualified to produce workmanship of specified quality.

A thorough inspection shall be performed as required by laws, codes, regulations, or specifications and shall confirm and document that all installations have been reviewed, are complete, and are in conformance with applicable specifications and workmanship requirements.

The design and construction will follow all applicable NESCTM and NECTM standards to guarantee a quality installation.

13.3.3. Receiving

All incoming material, components, and structures shall be subject to a visual inspection upon arrival. All equipment, materials, products, design, and construction shall be in conformance with contract documents, design drawings, and specifications and the requirements of this section. Material and equipment shall be stored and protected prior to installation per manufacturer's instructions. The equipment receiving inspection form shall be utilized upon receipt of large equipment components. The equipment receiving inspection form shall become part of the project turnover package to owner/customer.

13.3.4. Grounding

A visual and mechanical inspection of the grounding system shall be conducted to ensure grounding cable, ground rods, and exothermic or mechanical ground connection(s) are in compliance with engineer drawings and specification.

Structure grounding shall be tested according to engineer specifications and recommendations. The structure ground test reports shall become part of the project turnover package to owner/customer.

13.3.5. Foundations

Foundation excavations shall be visually inspected prior to concrete placement to ensure excavation and reinforcing steel is consistent with design specifications. The structure inspection (concrete foundation) form shall be completed prior to concrete placement. The structure inspection (concrete inspection) form and subgrade test reports shall become part of the turnover package to the owner/customer.

13.3.6. Mill Certification

A mill certification form shall be provided by the manufacturer at the time of delivery of the anchor bolts, embed rings, and reinforcing steel used on the project. Embedment of these items shall not take place until the mill certifications have been received by Company Construction, Inc.. All mill certifications shall be submitted to the structural engineer for approval. The mill certifications shall become part of the turnover package to owner/customer.

13.3.7. Concrete Testing

An independent testing agency will be utilized to sample and test concrete. A record of concrete test specimen results will be provided by the independent testing company using their standard report form. Concrete test cylinders shall be made following the recommendations of the ACI or according to foundation specifications. Cylinders shall be made, handled, and cured in accordance with ASTM C31 and shall be strength tested in accordance with ASTM C39 along with the foundation specifications. Test reports shall become part of the turnover package to the owner/customer.

14. Operation and Maintenance Building

14.1. Purpose

The purpose of this section is to establish and delineate the task planning and quality assurance methods and procedures to be used for the testing, examination, and inspection of the operation and maintenance building (O&M) construction applications.

14.2. Scope

The following is a summary list of the operations and items for which quality control functions will apply:

- Critical permits
- Inspections and testing
- Concrete
- Structural
- Mechanical and electrical

14.3. Method

The LFE or designee is responsible for the execution of this section. The Company Construction, Inc. subcontractor shall have a procedure of their own that equals or exceeds this procedure. Prior to execution of work, a planning meeting shall be held. At the planning meeting, the subcontractors shall demonstrate the quality plan that will be followed. Subcontractors shall also provide examples of supporting documentation to verify compliance with the quality plan for the work.

A survey control system for those items deemed necessary by Company Construction, Inc. shall be established, and baselines/benchmarks shall be located on-site. As deemed appropriate by Company Construction, Inc., survey work performed by or for subcontractors may be independently verified by an independent professional surveyor provided by Company Construction, Inc..

The owner/customer shall be responsible to provide the precise location of O&M building. Company Construction, Inc. shall obtain owner/customer approval of the physical location of O&M building prior to beginning work at location.

The following is a summary list of the operations and items for which quality control functions will apply:

- Foundation construction
- Foundation backfill
- Plumbing installation
- HVAC installation
- Electrical installation
- Architectural installation

15. Measuring and Test Equipment

15.1. Purpose

The purpose of this section is to ensure that the testing and measurement equipment provides accurate results of tests or measurements performed.

15.2. Scope

This procedure covers all measuring and testing equipment used by Company Construction, Inc. and Company Construction, Inc. subcontractors' measurement to accept or reject work or products.

15.3. Method

Company Construction, Inc. LFE or designee is responsible for the execution of this procedure.

Company Construction, Inc. and its subcontractors shall determine the necessary measuring and testing equipment based on applicable testing standards, on usual and customary industry practice, and the measurement and testing requirements of the contract documents.

All measuring and testing equipment shall be calibrated in accordance with applicable testing standards and equipment manufacturer recommendations.

- Use standards which are traceable to national standards.
- Have appropriate re-calibration intervals.
- Employ the use of a sticker or other means necessary that indicates the next re-calibration date of the measuring or testing equipment
- All calibration certificates associated with site tooling shall be filed on site. An electronic copy shall be stored by Company Construction, Inc. management for future reference.

All measuring and testing equipment shall be identified and stored in a suitable manner to protect from damage or distortion.

Prior to use, the date of last calibration is to be verified by FE or designee. In those instances where contract documents require additional measures, the measure specified, or its approved equivalents, are to be followed. Additionally, if the accuracy of the instrument is suspect for any reason, the instrument shall not be used until proper calibration is confirmed.

15.3.1. Company Construction, Inc. Testing

All testing required in the specifications shall be conducted and documented per contract requirements. Testing is performed for compliance and the integrity of the work performed. Test reports shall be completed by the FE directly responsible for the work performed. All testing reports that fail project testing specifications shall not be accepted. The FE directly responsible for the testing performed shall initiate a non-conformance report. All non-conformance reporting procedures shall be followed.

15.3.2. Third Party Testing

Third party testing is performed to increase the level of accountability and meet engineer or owner/customer requirements. Third party testing shall be coordinated directly by the FE responsible for the testing performed. The FE directly responsible for the testing performed shall review and approve all reports for acceptance. Third party testing reports that fail project testing specification shall not be accepted. The FE directly responsible for the testing performed shall initiate a non-conformance report. All non-conformance reporting procedures shall be followed.

16. Non-Conformance/Corrective and Preventative Action

16.1. Purpose

The purpose of this section is to ensure that work including supplied components which do not conform to the contract documents requirements is prevented from use or installation.

An additional purpose of this section is to ensure that corrective and preventative action is taken to eliminate the root cause(s) of non-conformance.

16.2. Scope

The scope of this section covers all work and/or equipment installed during the construction phase of the project. All project activities affecting quality are covered by this procedure.

16.3. Method (Procedure)

The LFE or designee is responsible for the execution of this procedure.

In planning work, prior experience, associated lessons learned, and other resources, such as co-workers and historical non-compliance reports, shall be employed to identify and prevent potential non-conformance.

16.3. Method (Procedure) (continued)

Non-conforming work or components discovered during inspections or tests shall be recorded on the non-conformance report.

Work or components which are deemed non-compliant shall be identified by the placement of a red tag on the work or component, indicating that it is non-compliant and may not be used.

16.3.1. External Non-Conformance

For external (non-company) non-conformance issues, a copy of the non-conformance report shall be distributed to the customer and to the party responsible for the non-compliant item(s). The non-conformance report shall direct the party responsible for the non-compliant item(s) to submit immediately a plan of action for correcting the item along with a schedule indicating when the work will be complete.

16.3.2. Internal Non-Conformance

For internal (company) non-conformance issues, a copy of the non-conformance report shall be distributed to the LFE, FE, foreman, and superintendent responsible for the work. An information copy shall also be distributed to the PM and general superintendent. The LFE shall be responsible for the determination of the proper course of action, for the resolution of the issue, and for communicating the solution to all applicable parties.

Upon execution of the resolution, the foreman responsible for execution of the resolution shall provide notice to the FE responsible for the work. The FE shall inspect the corrective action taken and close the non-conformance issue at such a time as the work passes inspection. The FE shall provide notice to all applicable parties when the corrective action is compliant with applicable specifications. The FE shall sponsor a meeting with the parties involved with the non-compliant work to determine the root cause of the issue.

The FE shall be responsible for distributing a "Lessons Learned" memo indicating the issue, the root cause, the solution, and the means for prevention of a reoccurrence to the director of project management and safety and quality.

16.3.3. Repair or Replacement of Non-Compliant Item(s)

At such time as the repair or replacement of the non-compliant item(s) is complete, measurements, tests, and inspections shall be performed to determine if the item(s) are compliant with the applicable requirements. At such time as the result of this work is complete and the item(s) are in fact compliant, they shall be approved for incorporation into the work.

17. Control of Quality Documentation

17.1. Purpose

The purpose of this section is to provide a method for identification, collection, accessing, filing, storage, maintenance, and disposition of quality records. These records are maintained to demonstrate conformance to contract document requirements and the effective operation of the wind energy quality control plan. Additionally, the purpose is to provide a method of preparing the turnover packages required by contract, a major portion of which will be quality records.

17.2. Scope

All Company quality records and turnover packages defined by contract are covered by this procedure. Pertinent subcontractor quality records and supplier/other data shall be components of these records and packages.

17.3. Method (Procedure)

All site related quality inspections, test reports, qualifications, etc. will be submitted to the LFE for review. The LFE will review the documents for errors, content, and neatness. If the document is reviewed and proven to be incomplete or incorrect, the document will be re-issued to the submitting party for correction and re-submission. Once the LFE reviews the document as acceptable, the document will be scanned and filed by the site administrator. A hard copy and an electronic copy will be filed on site. The copies will be stored in books/files relating to the turbine associated with the document or to the area of work associated, i.e. civil, substation, collection, O&M building, etc. The documents will also be tracked on a log which is utilized to track what documents have been submitted and what documents are outstanding.

17.3.1. Turnover Package Items

Turnover packages shall include, but is not limited to, the following information:

- Technical information for the work that was performed.
- Company quality control inspections
- Subcontractor inspections
- Manufacturer test reports
- Field test reports
- Third party inspections and test reports
- Personnel qualification records
- Material traceability records, if required
- Product data information
- Other documents applicable to the quality of the project

17.3.2. Turnover Book

Project turnover books are designed to aid in the organization of the turnover packages. There are many different parts of a project that will require a turnover book. Depending on the size of the project and scope of work, the indicated project may contain the following turnover book(s):

- Civil/roads
- Wind turbine generator (WTG)
- Collection system
- Substation and/or interconnect
- Transmission line
- Other, if applicable

Appendix A: Quality Control Inspections

General Notes:

If applicable, the following inspection forms shall be utilized or modified as appropriate for the indicated project.

If the subcontractor or the owner/customer provide documentation for similar inspection, use the subcontractor or owner/customer documentation. If possible or needed, add additional required company information to the provided inspection form.

Form of Job Books

The form of job books provides a table of contents view of the typical inspections and tests that are performed and documented to assure quality of construction. Inspections may be deleted, added, or modified based on project specifics.

The below list shows what the job books will look like and what will be contained in them. The contents and order may change in order to make them project specific.

1. Civil Construction Book

Table B: Civil Construction Book

1a	C-01 Construction Period Road Inspection
1b	Third Party Proof Roll Test Results
1c	Third Party Density Results
1d	C-03 Crane Pad Inspection
1e	Third Party Proof Roll Test Results
1f	Third Party Density Results
1g	C-05 Seeding Inspection
1h	C-06 WTG Site and Road Restoration Inspection
1i	C-07 Intersection Modification
1j	C-08 Approach/Temporary Radius
1k	C-09 Intersection Modification Restoration
1l	C-10 Yard Subgrade and Gravel Placement
1m	Punch Lists

2. WTG Books

Table C: WTG Book

1	WTG Foundation Material Receiving Inspections
1a	FR-1 Template Ring Receiving Inspection
1b	FR-2 Embedment Ring Receiving Inspection
1c	FR-3 Anchor Bolt and Hardware Receiving Inspection
1d	FR-4 Pedestal Form Receiving Inspection
1e	FR-6 Anchor Bolt Cage Data
2	WTG Foundation Documents
2a	F-1 Foundation Excavation Inspection
2b	Third Party Subgrade Acceptance Report
2c	F-2 Mud Mat Inspection
2d	F-3 Bottom Mat Inspection
2e	F-4 Anchor Bolt Cage Inspection
2f	F-5 Top Mat Inspection
2g	F-6 Pedestal Rebar and Conduit Pre-Pour Inspection
2h	F-7 Pre-Pour and Form Inspection
2i	F-8 Concrete Placement Inspection
2j	Third Party Concrete Field Test Summary Report
2k	Third Party Concrete Break Results
2l	F-9 Foundation Grounding and Pre-Backfill Inspection
2m	F-10 Foundation Backfill Inspection
2n	Third Party Foundation Backfill Compaction Results
2o	Foundation Ground Grid Performance Test Results
3	WTG Foundation Material Certificates
3a	Reinforcing Steel Mill Certificates
3b	Anchor Bolt Mill Certificates
3c	Embedment Ring Mill Certificate
3d	Mud Mat Concrete Tickets
3e	Foundation Concrete Tickets

2. WTG Books (continued)

Table C: WTG Books (continued)

4	WTG Component Receiving Documents
4a	R-1 Power Unit Receiving Inspection
4b	R-2 Tower Section Receiving Inspection (Base)
4c	R-2 Tower Section Receiving Inspection (Mid)
4d	R-2 Tower Section Receiving Inspection (Top)
4e	R-3 Nacelle Receiving Inspection
4f	R-4 Hub Receiving Inspection
4g	R-5 Blade Receiving Inspection (1)
4h	R-5 Blade Receiving Inspection (2)
4i	R-5 Blade Receiving Inspection (3)
5	WTG Installation Documents
5a	E-1 Mounting of Power Unit
5b	E-2 Base Erection Inspection
5c	E-3 Grout Placement Inspection
5d	Third Party Grout Break Results
5e	E-4 Base Tensioning and 10% Inspection
5f	E-5 Mid Erection Inspection
5g	E-6 Top Erection Inspection
5h	E-7 Nacelle Prep Inspection
5i	E-8 Nacelle Pre-Lift Inspection
5j	E-9 Nacelle Erection Inspection
5k	E-10 Rotor Assembly Inspection
5l	E-11 Blade to Hub Tensioning and 10% Inspection
5m	E-12 Rotor Erection Inspection
5n	E-13 WTG Torque Form
5o	E-14 WTG 10% Inspection
5p	FAA Lights Manual, If Applicable
5q	Fall Arrest System Manual/Checklist, If Applicable
5r	Climb Assist Commissioning/Inspection Report, If Applicable
6	Completion Certificates
6a	Foundation Completion Certificate
6b	Turbine Supplier Installation Checklist
6c	Walk Down Punch List
6d	WTG Mechanical Completion

3. Collection (Feeder) Book

Table D: Collection (Feeder) Book

	Feeder (A)
A1	Cable Installation Summary
	CS-9 Cable Installation Inspections
A2	Junction/Splice Box Log
	CS-11 Junction Box Inspections
A3	Cable Splice Log
	CS-12 Cable Splice Inspection
A4	Fiber Splice Log
	CS-15 Fiber Splice Inspections
A5	Directional Bore
	CS-16 Directional Boring Inspections
	Feeder (B)
B1	Cable Installation Summary
	CS-9 Cable Installation Inspections
B2	Junction/Splice Box Log
	CS-11 Junction Box Inspections
B3	Cable Splice Log
	CS-12 Cable Splice Inspection
B4	Fiber Splice Log
	CS-15 Fiber Splice Inspections
B5	Directional Bore
	CS-16 Directional Boring Inspections
	Continued as applicable for the number of Feeders

4. Collection (Tower) Book

Table E: Collection (Tower) Book

1	CS-1 Box Pad Inspections
2	CS-2 Transformer Receiving Inspections
3	CS-3 Transformer Inspections
4	CS-5 Transformer Energization Check Lists
5	Collection System Cable Management Log
6	CEI Total Placed Cable Log
7	CEI Daily Plow Logs
8	CEI Directional Bore Log
9	Collection System Progress Report
10	Collection System MV Cable and Transformer Receiving Log
11	MV Cable Manufacturer Certified Test Reports
12	MV Cable Megger Test Results on Reel
13	MV Cable PD Test Results Installed
14	Fiber Optic Manufacturer Certified Test Reports
15	Fiber Optic OTDR Test Results on Reel
16	Fiber Optic OTDR Test Results Installed
17	Miscellaneous Collection System Documents

5. Substation Book

Table F: Substation Book

1	Grounding
1a	S-1 Ground Grid Inspection
1b	Ground Grid Resistivity Test Results
2	Conduit
2a	S-2 Conduit Inspection
2b	S-4 Cable Tray Inspection
3	Foundation Documents
3a	S-3 Foundation Inspection
3b	Third Party Subgrade Compaction Test Results
3c	Reinforcing Steel Mill Certificates
3d	Anchor Bolts Mill Certificates
3e	Embedment Ring Mill Certificates
3f	Concrete Tickets
3g	Third Party Concrete Break Test Results
4	Equipment
4a	S-5 Equipment Receiving Inspection
4b	S-6 Equipment Inspection
5	Structures
5a	S-7 Structure Inspection
5b	Steel Mill Certificates
6	Overhead Bus
6a	S-8 Overhead Bus Inspection
6b	Aluminum Bus Welding Certificates
6c	Manufacturer Certified Test Report
7	Control Building
7a	S-9 Control Building Inspection
8	Substation Yard
8a	S-10 Substation Yard Inspection

5. Substation Book (continued)

Table F: Substation Book (continued)

9	Field Test Results
9a	SF6 Gas Sample Test Results
9b	Step Voltage Test Results: Circuit Integrity Testing
9c	34.5 kV Breaker Test Results
9d	34.5 kV Switch Test Results
9e	HV Breaker Test Results
9f	HV Switch Test Results
9g	HV Metering Test Results
9h	Control Building Battery Test Results
9i	Main Power Transformer Test Results
9j	Protective Relay Test Results
9k	Energization Test Results
9l	Medium Voltage Cable Field Test Reports
9m	Fiber Optic Field Test Reports
	Appendix A: Material and Equipment
	Equipment Specifications and Information
	Manufacturer Certified Test Report
	Equipment Instruction Manuals
	Equipment Warranty Information
	Material Product Data
	Appendix B: Permits and Drawings
	Permits
	Design Drawings

6. Interconnect

Table G: Interconnect

1	Grounding
1a	S-1 Ground Grid Inspection
1b	Ground Grid Resistivity Test Results
2	Conduit
2a	S-2 Conduit Inspection
2b	S-4 Cable Trenwa Inspection
3	Foundation Documents
3a	S-3 Foundation Inspection
3b	Third Party Subgrade Compaction Test Results
3c	Reinforcing Steel Mill Certificates
3d	Anchor Bolts Mill Certificates
3e	Embedment Ring Mill Certificates
3f	Concrete Tickets
3g	Third Party Concrete Break Test Results
4	Equipment
4a	S-5 Equipment Receiving Inspection
4b	S-6 Equipment Inspection
5	Structures
5a	S-7 Structure Inspection
5b	Steel Mill Certificates
6	Overhead Bus
6a	S-8 Overhead Bus Inspection
6b	Aluminum Bus Welding Certificates
6c	Manufacturer Certified Test Report
7	Control Building
7a	S-9 Control Building Inspection
8	Substation Yard
8a	S-10 Substation Yard Inspection

6. Interconnect (continued)

Table G: Interconnect (continued)

9	Field Test Results
9a	SF6 Gas Sample Test Results
9b	Step Voltage Test Results - Circuit Integrity Testing
9c	34.5 kV Breaker Test Results
9d	34.5 kV Switch Test Results
9e	HV Breaker Test Results
9f	HV Switch Test Results
9g	HV Metering Test Results
9h	Control Building Battery Test Results
9i	Main Power Transformer Test Results
9j	Protective Relay Test Results
9k	Energization Test Results
9l	Medium Voltage Cable Field Test Reports
9m	Fiber Optic Field Test Reports
	Appendix A: Material and Equipment
	Equipment Specifications & Information
	Manufacturer Certified Test Report
	Equipment Instruction Manuals
	Equipment Warranty Information
	Material Product Data
	Design Drawings

7. Transmission Line Book

Table H: Transmission Line Book

TL-1	Structure Inspection (Direct Embed)
TL-2	Structure Inspection (Concrete Foundation)
TL-3	Structure Guying Inspection
TL-4	Transmission Line Inspection
TL-5	Misc. Equipment Receiving Inspection
App A	Transmission Line Test Reports

8. O&M Book

Table I: O&M Book

OM-1	Critical Plan Approval Check List
OM-2	Third Party Inspection and Testing
OM-3	Footing and Column Pad Inspection
OM-4	Foundation Walls Inspection
OM-5	Backfill Inspection
OM-6	Plumbing Inspection
OM-7	Slab on Grade Inspection
OM-8	Structural Inspection
OM-9	Architectural Inspection
OM-10	Mechanical & Electrical Inspection

Inspection and Test Plan: Civil Inspections

The “Inspections and Test Plan” section provides an example of a full inspection and test plan for “Civil Construction Block” in the form of job books. A similarly detailed inspection and test plan exists for each section of the form of job books.

1. Civil Inspections

C-1	Construction Period Road Inspection
C-2a	Initial Drainage Structure Inspection
C-2b	Final Drainage Structure Inspection
C-3	Crane Pad Inspection
C-4	Drain Tile Repair Inspection
C-5	Seeding Inspection
C-6	WTG Site and Road Restoration Inspection
C-7	Intersection Modification
C-8	Approach/Temporary Radius
C-9	Intersection Modification Restoration
C-10	Yard Subgrade and Gravel Placement

Inspection and Test Plan: Civil Inspections

TBD Wind Energy Project

C-1 Construction Period Road Inspection

0

Road Name or Identifier: _____ Road Length _____ ft.

Drawing #: _____

Subgrade Preparation

Inspection Compliance

1. Topsoil removed per drawings.	Yes	No
2. Subgrade prepared per drawing and specifications.	Yes	No
3. Subgrade passed proof roll testing.	Yes	No
4. Third party proof roll and subgrade testing data collected and filed.	Yes	No
5. SWPPP installed per drawings and specifications.	Yes	No

Road Base Installation

6. Geotextile fabric installed per drawings and specifications.	Yes	N/A	No
7. Road base passed proof roll testing.	Yes		No
8. Road shoulders passed proof roll test (both sides).	Yes	N/A	No

Road Specifications

Gravel Design Width: _____ft. Gravel Design Thickness: _____in. Compacted Shoulder Width: _____ft.

Side to side Max Grade: _____in. Maximum in 100' Crest: _____in. Maximum in 100' Sag: _____in.

#	Station or GPS Location:	Actual Gravel Width (ft.):	Actual Shoulder-to-Shoulder-Width (ft.):	Actual Gravel Thickness (ft.):	Shoulder-to-Shoulder Elevation Difference (in.):	Actual Side-to-Side Slope: %
1						
2						
3						
4						
5						
6						
7						
8						

Road Checks shall be performed at a minimum every 500'. If needed, use additional sheets.

Inspection Compliance

9. Road width and thickness installed per design tolerances.	Yes	No
10. Road section incline grade less than ____% grade per specifications.	Yes	No
11. Road section maximum side-to-side grade within specifications.	Yes	No
12. Maximum vertical crest in any 100' section within specifications. (____inches)	Yes	No
13. Maximum vertical sag in any 100' section within specifications. (____inches)	Yes	No
14. Were there any Non-Conformance Reports filed?	Yes	No
If yes, list NCR #____. Has it been resolved?	Yes	N/A No

Inspection and Test Plan: Civil Inspections

C-1 Construction Period Road Inspection

Photos

***Representative will do a drive-thru inspection and a completion certificate
for each section of road will be issued at the end of the project.*
Note any deviations in the comments section.**

Comments:

Civil Foreman: _____ **Date:** _____

QA/QC: _____ **Date:** _____

Inspection and Test Plan: Civil Inspections

TBD Wind Energy Project

C-2a Initial Drainage Structure Inspection

0

Road Name or Identifier: _____ Road Length _____ ft.

Drawing #: _____

Subgrade Preparation

1. Topsoil removed per drawings.
2. Subgrade stabilization prepared per drawing and specifications.
3. Moisture data collected prior to stabilization.
4. Percent of stabilization: _____ %
5. Stabilized Subgrade passed proof roll testing.
6. Third party proof roll and subgrade testing data collected and filed.
7. SWPPP installed per drawings and specifications.

Soil Moisture %: _____

Type of Stabilization: _____

Inspection Compliance

Yes	No
Yes	N/A No
Yes	N/A No
Yes	No
Yes	No
Yes	No

Road Base Installation

8. Geotextile fabric installed per drawings and specifications.
9. Road base passed proof roll testing.
10. Road shoulders passed proof roll test (both sides).

Yes	N/A	No
Yes		No
Yes	N/A	No

Road Specifications

Gravel Design Width: _____ ft. Gravel Design Thickness: _____ in. Compacted Shoulder Width: _____ ft.

Side to side Max Grade: _____ in. Maximum in 100' Crest: _____ in. Maximum in 100' Sag: _____ in.

#	Station or GPS Location:	Actual Gravel Width (ft.):	Actual Shoulder-to-Shoulder-Width (ft.):	Actual Gravel Thickness (ft.):	Shoulder-to-Shoulder Elevation Difference (in.):	Actual Side-to-Side Slope: %
1						
2						
3						
4						
5						
6						
7						
8						

Road Checks shall be performed at a minimum every 500'. If needed, use additional sheets

Inspection Compliance

11. Road width and thickness installed per design tolerances.
12. Road section incline grade less than _____ % grade per specifications.
13. Road section maximum side-to-side grade within specifications.
14. Maximum vertical crest in any 100' section within specifications. (_____ inches)
15. Maximum vertical sag in any 100' section within specifications. (_____ inches)
16. Were there any Non-Conformance Reports filed?
If yes, list NCR # _____. Has it been resolved?

Yes	No
Yes	No
Yes	No
Yes	No
Yes	No
Yes	No
Yes	N/A No

Inspection and Test Plan: Civil Inspections

C-2a Initial Drainage Structure Inspection

Photos

***Representative will do a drive-thru inspection and a completion certificate
for each section of road will be issued at the end of the project.*
Note any deviations in the comments section.**

Comments:

Civil Foreman: _____ **Date:** _____

QA/QC: _____ **Date:** _____

Inspection and Test Plan: Civil Inspections

TBD Wind Energy Project

C-2b Final Drainage Structure Inspection

0

Structure(s) Identification: _____

Drawing #: _____

Location of Structure: _____

Type of Structure: CMP ☐ RCP ☐ Other: ☐ _____

Number of Structures: _____ Structure Width: _____ Structure Length: _____

Direction of Drain From: _____ Direction of Drain To: _____

Difference in Elevation End to End: _____

Inspection Compliance

1. Culvert has not been damaged during construction activities.	Yes	No
2. If drainage structure is to be placed in county or state ROW, applicable permits have been reviewed and complied with.	Yes	N/A No
3. Sides and bottom of excavation are consistent with design and manufacturer specs.	Yes	No
4. Excavation has been cleaned of all loose debris.	Yes	No
5. Structure width and length per design specifications.	Yes	No
6. Bedding material added per specifications.	Yes	N/A No
7. Coupling bands installed and tightened.	Yes	N/A No
8. Inlet and Outlet meets existing grade or design requirements and design requirements of >1% slope.	Yes	No
9. Fill meets existing road grade and manufacturers specifications: no humps or dips.	Yes	No
10. End sections installed per design specifications.	Yes	N/A No
11. SWPPP installed per drawings and specifications: silt fence, rip rap, etc.	Yes	No
12. Drainage Structure installed per drawings and specifications.	Yes	No
13. Actual amount of cover _____ inches over culvert.	Yes	No
14. Were there any Non-Conformance Reports filed?	Yes	No
If yes, list NCR #____. Has it been resolved?	Yes	N/A No

Inspection and Test Plan: Civil Inspections

C-2b Final Drainage Structure Inspection

Photos

Note any deviations in the comments section.

Comments:

Civil Foreman: _____ **Date:** _____

QA/QC: _____ **Date:** _____

Inspection and Test Plan: Civil Inspections

TBD Wind Energy Project

0

C-3 Crane Pad Inspection

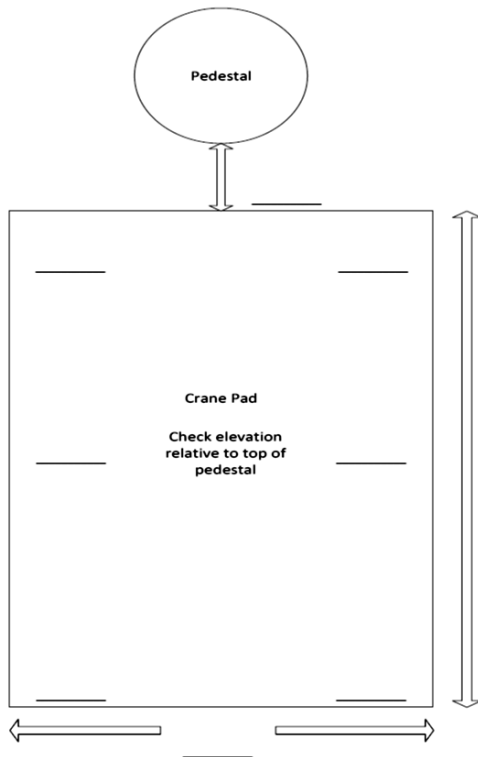
WTG #: _____

Drawing #: _____

Date: _____

Inspection Compliance

- | | | |
|---|-----|----|
| 1. Location of crane pad per design drawings and reviewed by initialed Superintendents. | Yes | No |
| 2. Backfill compaction report has been reviewed and specifications have been met. | Yes | No |
| 3. All unsuitable material removed from crane pad footprint. | Yes | No |



Crane Pad Specifications		
Measurements	Design	Actual
Length:		
Width:		
Maximum out of level value: <1%		Actual Difference: (in.)
Measurements	Design	
Front/Back: _____%	< 1%	
Side/Side: _____%	< 1%	
Corner/Corner: _____%	< 1%	
Corner/Corner: _____%	< 1%	

- | | | |
|--|-----|----|
| 4. Length and width of crane pad within design specifications. | Yes | No |
| 5. Distance from front of crane pad to edge of pedestal per design specifications. | Yes | No |
| 6. Relative height of the crane pad to the turbine pedestal within tolerances. | Yes | No |
| 7. Crane pad level within tolerances. | Yes | No |
| 8. Subgrade compacted per drawings and specifications. | Yes | No |
| 9. Crane pad base passed density testing or proof roll testing. | Yes | No |

Type of subgrade test:

10. ☐ Proof Roll ☐ DCP Test ☐ Other: _____

- | | | |
|---|-----|----|
| 11. Verify that water will not pond on crane pad. | Yes | No |
|---|-----|----|

- | | | |
|---|-----|----|
| 12. Were there any Non-Conformance Reports filed? | Yes | No |
|---|-----|----|

If yes, list NCR #____. Has it been resolved?	Yes	N/A	No
---	-----	-----	----

Inspection and Test Plan: Civil Inspections

C-3 Crane Pad Inspection

Photos

Note any deviations in the comments section.

Comments:

Civil Foreman: _____ **Date:** _____

Erection Superintendent: _____ **Date:** _____

QA/QC: _____ **Date:** _____

Inspection and Test Plan: Civil Inspections

TBD Wind Energy Project

0

C-4 Drain Tile Repair Inspection

Date: _____

GPS Datum Used: _____

Drain Tile ID: _____

Property Owner: _____

Tenant (if applicable): _____

GPS Location

Latitude #1: _____

Latitude #2: _____

Longitude: _____

Longitude: _____

Existing Drain Tile Type: Clay ☐

Corrugated Plastic ☐

Concrete ☐

PVC ☐

Other ☐ Description: _____

Replacement Tile Type: Clay ☐

Corrugated Plastic ☐

Concrete ☐

PVC ☐

Other ☐ Description: _____

Repaired Drain Tile Length: _____

Drain Tile Diameter: _____

Location of Damaged Tile: _____

Company Responsible for Repairing Damaged Tile: _____

Date Tile Was Repaired: _____

Inspection Compliance

1. Drain tile repaired properly.	Yes	No
2. Photograph(s) taken of completed repair and filed in appropriate file.	Yes	No
3. Land Owner willing to sign off on repair.	Yes	No
4. Were there any Non-Conformance Reports filed?	Yes	No
If yes, list NCR #____. Has it been resolved?	Yes	N/A No

Inspection and Test Plan: Civil Inspections

C-4 Drain Tile Repair Inspection

Photos

Note any deviations in the comments section.

Comments:

Civil Foreman: _____ **Date:** _____

Landowner/Representative: _____ **Date:** _____

QA/QC: _____ **Date:** _____

Inspection and Test Plan: Civil Inspections

TBD Wind Energy Project

C-5 Seeding Inspection

0

Date of Seeding: _____

Seeding Locations: _____

Type of Seed Mix: _____

Type of Fertilizer Used: _____

Mixtures and Amounts: _____

Quantity of Seed Bags Used: _____

Size of Bag: _____ lbs.

Note: File all seed tickets behind inspection form.

Seeding Installation Method:

Mechanical Drill ☐

Hydro Seeding ☐

Other ☐ _____

Seed Placement Inspection

Inspection Compliance

1. Verify seed mix is the correct mix design per specifications. Review approved seeding submittal.	Yes	No
2. Soil is properly tilled prior to seeding.	Yes	No
3. Seed uniformly placed on designated area.	Yes	No
4. Final stabilization BMPs (mulch, blankets, cover crops, etc.) installed per specifications.	Yes	N/A No
5. Irrigation plan implemented after seeding and fertilizer installation.	Yes	N/A No
6. Land Owner willing to sign off on seeding inspection.	Yes	N/A No
7. Photos taken of installation process.	Yes	No
8. Were there any Non-Conformance Reports filed?	Yes	No
If yes, list NCR #____. Has it been resolved?	Yes	N/A No

Inspection and Test Plan: Civil Inspections

C-5 Seeding Inspection

Photos

Note any deviations in the comments section.

Comments:

Installation Foreman: _____ **Date:** _____

Owner Representative *If Applicable*: _____ **Date:** _____

QA/QC: _____ **Date:** _____

Inspection and Test Plan: Civil Inspections

TBD Wind Energy Project

C-6 WTG Site and Road Restoration Inspection

0

Road Name or Identifier: _____ Road Length: _____ ft.

WTG Sites Included: _____

Subgrade Preparation

Inspection Compliance

1. WTG site and turning radius final grading completed per specifications.	Yes	No
2. WTG gravel ring(s) installed and compacted per specifications.	Yes	N/A No
3. WTG anchor bolt covers installed per specifications.	Yes	N/A No
4. WTG ID stickers installed per owner requirements.	Yes	N/A No
5. Crane pad(s) removed and area restored to original grade and compaction.	Yes	N/A No
6. Spoil material and large rocks removed from WTG site and road areas.	Yes	No
7. All truck turnaround areas removed and restored to original grade and compaction.	Yes	N/A No
8. Road shoulders de-compacted and restored to pre-construction conditions.	Yes	N/A No

Road Specifications

Gravel Design Width: _____ft. Gravel Design Thickness: _____in. Decompacted Shoulder Width: _____ft.

Side to side Max Grade: _____in. Maximum in 100' Crest: _____in. Maximum in 100' Sag: _____in.

#	Station or GPS Location:	Actual Gravel Width:	Actual Gravel Thickness:	Gravel edge to gravel edge Elevation Difference (in.):	Actual Side-to-Side Slope: %
1					
2					
3					
4					
5					
6					
7					
8					

Road Checks shall be performed at a minimum every 1000'. If needed, use additional sheets.

Inspection Compliance

9. Fencing and gates installed per drawings and specifications.	Yes	N/A	No
10. Road signage installed per owner/state/county requirements.	Yes	N/A	No
11. Proper BMPs installed per SWPPP plan.	Yes		No
12. County or state approved removal of turning radius.	Yes	N/A	No
13. Seeding and installation of final stabilization BMPs completed per drawings and specifications. Seeding inspection form has been filled out, completed, and filed (C-5).	Yes	N/A	No
14. Culvert end sections installed per specification. C-2 Drainage Structure Inspection form revised, finalized, or new form filled out to exhibit change due to restoration.	Yes	N/A	No
15. Were there any Non-Conformance Reports filed?	Yes		No
If yes, list NCR # . Has it been resolved?	Yes	N/A	No

Inspection and Test Plan: Civil Inspections

C-6 WTG Site and Road Restoration Inspection

Photos

Note any deviations in the comments section.

Comments:

Civil Foreman: _____ **Date:** _____

QA/QC: _____ **Date:** _____

Inspection and Test Plan: Civil Inspections

TBD Wind Energy Project

0

C-7 Intersection Modification Inspection

Intersection Mod. I.D.: _____ State ☐ County ☐ Permit #: _____

Drawing: _____ Effective Permit Date: _____

Location of Structure: _____

Type of Structure: Reverse ☐ Regular ☐ Other ☐ _____

Structure Height/Slope: _____ Structure Width: _____ Structure Length: _____

Sketch intersection modification in relation to nearby landmarks (streets, houses, power poles, etc.):

Inspection Compliance

1. Permit has been reviewed by Civil Supt/Subcontractor.	Yes	No
2. One call made. Ticket Number _____	Yes	No
3. Sloped so no ponding will accumulate (< 1%) per specifications.	Yes	No
4. Sloped away from existing road.	Yes	No
5. Maximum vertical crest or sag does not exceed ____ in. in any 100' section.	Yes	No
6. Approved culvert used/inspected. C-2 Drainage Structure Inspection form filled out and completed.	Yes	No
7. Fill meets existing road grade: no humps or dips.	Yes	No
8. Fabric installed per permit specifications.	Yes	N/A No
9. SWPPP BMPs installed per drawings and specifications: silt fence, rip rap, etc.	Yes	No
10. Intersection modification has been installed per permit.	Yes	N/A No
11. Signage installed per traffic control plan.	Yes	No
12. All work complies with state and local laws.	Yes	No
13. All work complies with SWPPP permit.	Yes	No
14. Were there any Non-Conformance Reports filed?	Yes	No
If yes, list NCR # _____. Has it been resolved?	Yes	N/A No

Note any deviations in the comments section.

Comments:

Civil Foreman: _____ Date: _____

QA/QC: _____ Date: _____

Inspection and Test Plan: Civil Inspections

TBD Wind Energy Project

C-8 Approach/Temporary Radius Inspection

0

Location of Structure: _____

Permit #: _____ Drawing: _____

Sketch Approach or Temporary Radius:

	<u>Inspection Compliance</u>		
1. Culvert inspections have been completed. C-2 Drainage Structure Inspection complete and filed.	Yes	N/A	No
2. Approach/temporary radius constructed per permit/design.	Yes		No
3. Fill material used per permit/design specifications.	Yes	N/A	No
4. Structure sloped to prevent ponding per permit and design specifications.	Yes	N/A	No
5. Radius meets existing grade and/or permit requirements.	Yes		No
6. Sloped/shored per permit/design specifications.	Yes		No
7. Radius installed per delivery requirements. Review drawings, including TSA E.1, civil, and permit drawings.	Yes	N/A	No
8. SWPPP installed per drawings and specifications: silt fence, rip rap, etc.	Yes		No
9. Drainage structure installed per drawings and specifications.	Yes	N/A	No
10. Were there any Non-Conformance Reports filed?	Yes		No
If yes, list NCR #____. Has it been resolved?	Yes	N/A	No

Note any deviations in the comments section.

Comments:

Civil Foreman: _____ Date: _____

QA/QC: _____ Date: _____

Inspection and Test Plan: Civil Inspections

TBD Wind Energy Project

C-9 Intersection Modification Restoration Inspection

0

Intersection Mod. I.D.: _____ State ☐ County ☐ Permit #: _____
Drawing: _____ Effective Permit Date: _____

Inspection Compliance

1. One call made for utility locations.	Yes	No
Ticket Number (if self performed): _____		
2. Final grading completed per permit and design specifications.	Yes	No
3. Ditch slope restored to existing slope prior to construction.	Yes	No
4. Culvert end sections installed per specification. C-2 Drainage Structure Inspection revised, finalized, or filled out to exhibit change due to restoration activities.	Yes	N/A No
5. Spoil material and large rocks removed from disturbed areas.	Yes	No
6. Road shoulders de-compacted and restored to pre-construction conditions.	Yes	N/A No
7. Fencing and gates installed per drawings and specifications.	Yes	N/A No
8. Road signage installed per owner/state/county requirements.	Yes	N/A No
9. Proper BMPs installed per SWPPP plan.	Yes	N/A No
10. Intersection modification reviewed and approved by state/county..	Yes	No
11. Seeding and final stabilization BMP installation completed per drawings and specifications.	Yes	N/A No
12. C-5 Seeding Inspection form has been filled out and completed.	Yes	No
13. Were there any Non-Conformance Reports filed?	Yes	No
If yes, list NCR # _____. Has it been resolved?	Yes	N/A No

(*Note any deviations in the comments section.*)

Comments:

Civil Foreman: _____ Date: _____

QA/QC: _____ Date: _____

Inspection and Test Plan: Civil Inspections

TBD Wind Energy Project

C-10 Misc. Sub Grade & Gravel Placement Inspection

0

Yard Name or Identifier & Sheet Number: _____

Acreage of Yard: _____

Passes Inspection

1. One call made for utility locations.	Yes	No
Ticket Number (If company/self performed): _____		
2. The yard is graded to promote positive drainage away from the yard to storm water outlets.	Yes	No
3. No visible humps or holes that would collect run off prior to gravel placement.	Yes	No
4. Final grading completed per permit and drawing specifications.	Yes	No
5. Subgrade passes Proof Roll Test.	Yes	No
6. Culvert sections installed per specification. C-2 Drainage Structure Inspection filled out.	Yes	N/A No
7. Spoil material and large rocks removed from disturbed areas.	Yes	No
8. Gravel depth checked and confirmed with subcontractor.	Yes	N/A No
9. Gravel placement length & width: Length: _____ x Width _____.	Yes	N/A No
10. Top soil piles located per drawings and specifications.	Yes	N/A No
11. Proper BMPs installed per SWPPP plan.	Yes	N/A No
12. Meets county set back and permitting requirements.	Yes	No
13. Seeding and stabilization BMP installation completed per drawings and specifications.	Yes	N/A No
14. C-5 Seeding Inspection form has been filled out and completed.	Yes	No
15. Were there any Non-Conformance Reports filed?	Yes	No
If yes, list NCR #____. Has it been resolved?	Yes	N/A No

Note any deviations in the comments section.

Comments:

Civil Foreman: _____ Date: _____

QA/QC: _____ Date: _____

Quality Control Procedure

The Quality Control Procedure provides an example of the documented procedure accompanying the "Construction Period Road Inspection" subsection of the "Civil Construction Block". A similarly detailed procedure exists for each inspection in the full inspection and test plan.

C-1 Road Inspection

1.0. Purpose

To ensure that the road installation is completed per design drawings and specifications.

2.0. Revision History

3.0. Required Tools & Equipment

- Personal Protective Equipment (PPE)
- 25' and 100' tape measure
- Laser level
- Digital level
- Pick axe
- Two steel pins
- String line
- Hammer
- Measuring wheel
- Wood lathes
- Paint pen
- Digital camera
- Civil drawings and specifications

4.0. Procedure

- 4.1.** Start by going through the inspection form line by line to know what you will need to look for once in the field. Also, fill in your job name, number, and the design specifications prior to printing the inspection form so you don't have to fill it out each time. Any changes to the C-1 Inspection form shall be approved.
- 4.2.** Before going out on site to inspect roads, bring your road drawings and specifications. Also bring the required tools and equipment.
- 4.3.** The first line on the inspection form will ask you for the road name or identifier. Each road section should have some sort of identification to determine the location of the inspection.

- 4.4.** The next item will ask you if the topsoil has been removed. It may seem obvious if you're working with grass land; however, if you are working in a plowed field it may be hard to notice if they really removed the top soil or not. If the top soil has been removed and is accepted, you can circle "Yes" and move to the next line. You will need to review the specifications for the required depth of the sub-grade.



Figure 4.1: Removing Top Soil

- 4.5.** The next line item will ask if the SWPPP Plan has been implemented and completed per specifications. Circle "Yes" if it is in place and move on with your inspection.
- 4.6.** Before placing any base material, there are a few things that need to happen before cutting the contractor loose. First, the material that is planned on being used must be submitted to the civil engineers for their approval (ensure it has been accepted). Second, the subgrade must be complete and passing. This may require a proof roll of the sub-grade or even a density test, each requiring a third party inspector to complete the test. Once either has been completed and is accepted, you can circle "Yes". It is a good practice to note when the sub-grade actually passed on your sheet as well.

C-1 Road Inspection (continued)

- 4.7. Next on your inspection form you will find it asks you if geotextile fabric has been installed. Typically geotextile fabric is required; however, some soil types do not require it. You will need to check your specifications to determine whether this is needed or not. If it is required, ensure it has been installed properly and circle "Yes".



Figure 4.2: Installing Geotextile Fabric

- 4.8. The next line item will ask if the compaction reports have passed specification requirements. For the road base material to pass inspection, you will need to get the compaction reports from your third party tester on-site, and the results must meet or exceed the specifications. A good practice is to track where the road base has passed compaction requirements on a map so you're not missing any reports when it comes to submitting them to the owners.



Figure 4.4: Compacting Road Base



Figure 4.5: Performing QC Check on Gravel Installation

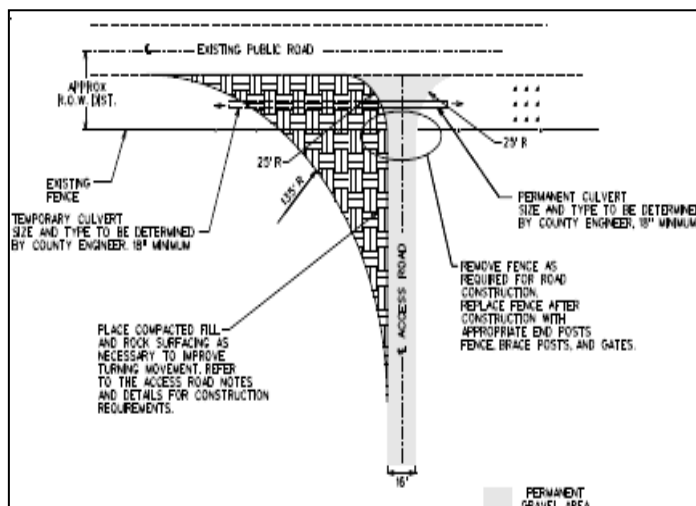


Figure 4.3: Typical Access Road Entrance Detail

- 4.9. The next line item will ask if the road radius for access points and curves has been installed per specifications. Usually the road radius is determined by the turbine manufacturer and transportation company. If inspection passes, circle "Yes" and move onto the next question.
- 4.10. The next step is to check your road width. Do so by placing two metal pins on each side of the road and measuring the distance between the two points. If there is a PE available to assist with the inspection, they can hold the other end of the tape instead of using the pins. This should be completed before the road shoulders have been pulled up. Once the shoulders have been pulled up, it will be hard to determine where the exact edge of the road is.

C-1 Road Inspection (continued)

4.11. Over the duration of the project, the thickness of the road will change from traffic and maintenance. So your QA/QC for the thickness of the roads should be complete when the final grading of the road has been done. However, you should spot check the depth of the roads during construction, as well, to avoid any major repair areas toward the end of the project. Try catching the problem areas while the crew is there placing the material, they are a lot more willing to do the work while they are in the area.

4.12. To complete the depth check, you will need your pick axe, tape measure, and wood lathe. Pick a hole in a random spot of the road (don't always do the center or edge of the road) until you reach the sub-grade. Once you have reached the sub-grade, measure from the top of the sub-grade to the top of the base material. This will give you the depth of the road. If this is within the tolerance of your design, it is acceptable. If not, you will need to get the contractor back and spot dump some material in the troublesome areas.

4.13. To measure crown height, take two bricks and a string line tied between the two. The distance between the bricks should be the width of the road. Use a tape measure to measure the distance from the string at the center and both edges. The distance at the edge minus the distance at the center should equal your crown height.

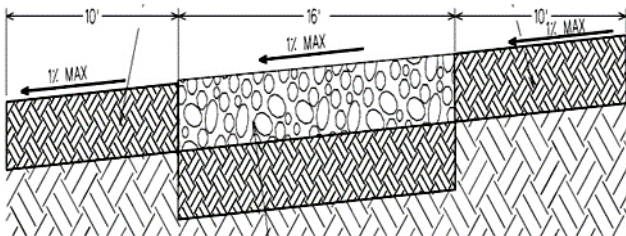


Figure 4.6: Typical Road Placement Cross Section

4.14. In some cases, the engineer may not require a crown to the road design. Instead they may design the road with a slope to maintain an existing drainage pattern (usually 1% to 2% max slope). You will need to adjust your inspection form accordingly.

4.15. Next you will need to check the actual grade of the road sections. The maximum grade should be per the engineer design and specifications. It is a good idea to double check with the crane manuals, as well, to make sure all ends are covered. If at all possible, check this before any base material is placed. If it is not within specifications, the

contractor will be able to work with the sub-grade a lot easier and cheaper than the base material. To complete the test, place your digital level on the road. The longer your level is, the more accurate your results will be. So if you have a small level, it is a good idea to place a piece of angle iron, or something that will stay true over the duration of the project, under your level. If your results come under your maximum allowable grade percentage, then the road is acceptable.

4.16. To check for dips and bumps, you can complete this task two ways. 1) Use a 100' tape measure and survey equipment or 2) take two bricks and a string line tied between the two. The distance between the bricks should be about 50'. Use a tape measure to measure the distance from the string to the road in high and low spots. If this distance is greater than the required dip or swale, it fails. Remember to subtract or add the height of the brick. It is important that you complete this inspection prior to any turbine component deliveries. If either of these are out of tolerance, the delivery trucks may get hung up and cause damage to their trucks.

4.17. In the comment section, record any notes that you feel add value to this inspection.

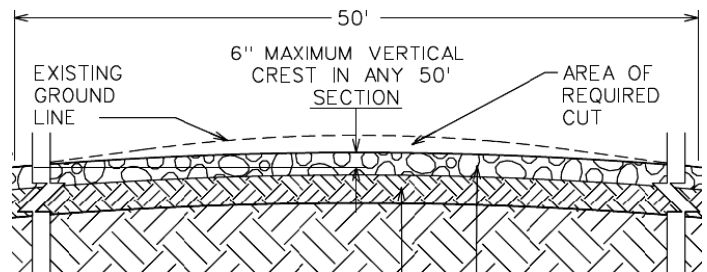


Figure 4.7: Typical Road Profile Crossing Existing Crest Area

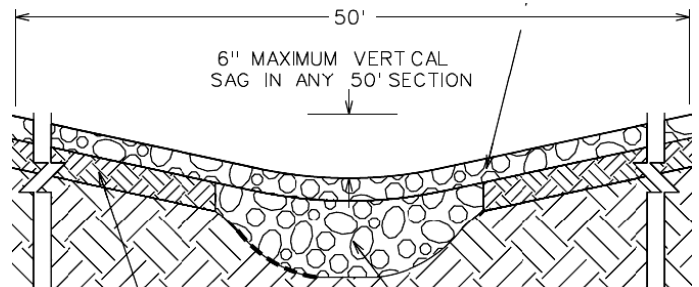


Figure 4.8: Typical Road Profile Crossing Existing Swale Area

C-1 Road Inspection (continued)

5.0 Approval

- 5.1.** Non-conformance notices (NCN) are written when there is an issue with some aspect of the road that cannot be fixed in a quick manner, e.g. that same day. If all NCNs have been closed, circle "Yes". If there is an open NCN issue, you will need to verify that it is closed.
- 5.2.** A photographic record is not required for each road section inspection. However, photos should be taken of the installation process and final product for documentation purposes.
- 5.3.** Depending on the dynamics of your project, there may be a few road modifications during construction. This may be due to landowner issues, wet land issues, or other. Ensure all road changes have been approved by the civil superintendent and all applicable parties (owner, landowner and civil engineer). The civil drawings shall be updated and redlined with all road changes.
- 5.4.** If all the items on this inspection form have been recorded and accepted, and all items are within the specified tolerances of the design drawings, the road is acceptable. Have the installation foreman, as well as yourself, sign the bottom of the form. The road inspection form will then be filed in its appropriate quality control book.

6.0. Records

- 6.1.** C-1 Road Inspection Form
- 6.2.** Photographic records of the road installation
- 6.3.** Third Party Subgrade Compaction Test Results
- 6.4.** Third Party Base Compaction Test Results
- 6.5.** Update Civil Drawings with all road changes, if applicable